

# A Systematic Review of the Literature in Nature on Human-Computer Interaction: Preliminary Results

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**Abstract.** For the past three decades, computers have been dominating the way many people create, manage, and use information. Subsequently, Human-Computer Interaction (HCI) became an essential area of Information Studies. Due to its interdisciplinary nature, HCI has been defined loosely by what its constituting fields, such as Information Studies, Computer Science and Psychology, perceive as HCI research. A broader view of HCI remains unclear. One way to formulate such a broad view is to examine how scientific journals that represent a wide range of disciplines portray HCI. One comprehensive and prestigious scientific community that mentions the term “human-computer-interaction” as a field of study in its published body of articles is the Nature publications and journals. Through multiple rounds of screening, we identified 53 relevant publications across the Nature database and analyzed these articles using the Qualitative Analysis of Content method. The preliminary results show an exponential increase in the use of the term “human-computer-interaction” over the past six years in Nature publications. Our results also suggest that the scientific community represented in Nature views HCI as an independent field of research.

**Keywords:** Human-Computer Interaction · Systematic Literature Review · Information Studies

## 1 Introduction

As more information is represented digitally, Human-Computer Interaction (HCI) becomes more central to Information Studies [3]. HCI has always been broadly defined on the macro level by researchers who identify with the field. This vagueness in perceiving HCI is due to its interdisciplinary nature. The term “human-computer interaction” was first coined and popularized by [1]. The focus of HCI is to study the design and use of computers, focusing on the interfaces between people and computers. Goals of what researchers in the field seek to achieve vary. For example, a psychologist may want to align computer interfaces with mental models that humans have of their activities. However, an information

scientist may want to align computer interfaces with existing social practices and socio-cultural values.

Similarly, a computer scientist may choose not to put much emphasis on the human side of the interaction when designing programs or interfaces. This diversity, even though innate to the field, created a discrepancy in the way HCI researchers define what HCI is. Broadness in the definition of HCI is also reflected in the Association of Computer Machinery (ACM) adopted definition that has been proposed by [4] as “a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them”.

We conducted a systematic literature review [2] to examine how the broad scientific disciplines represented by Nature view and perceive HCI. We intend to gain a fresh perspective on the definition of HCI from a scientific community outside of the regular HCI communities and conferences. Probing an unconventional community about what they think of HCI as a field will encourage the HCI community to look at itself from an outsider perspective. We chose Nature because their journals enjoy a high reputation and are consistently ranked amongst the best regarding impact factors. The previously mentioned reasons for choosing Nature reflect the importance of Nature in reporting the forefront of scientific development. Two of our primary research questions are: Q1: What are the topics and the fields of the publications across the Nature database that mention the term “human-computer-interaction” and its variants? Q2: In what context was the term “human-computer-interaction” and its variants mentioned?

## 2 Methods

### 2.1 Database Search

The Nature publishing group, Springer Nature, provides an online database covering 151 affiliated journals. Nature journals specialize in publishing peer-reviewed articles in many branches of science (e.g., Chemistry, Physics, Engineering, ...). The database “nature.com” can be accessed through <https://www.nature.com/search/advanced>. The original keywords used for the search were: “human-computer-interaction” and “computer-human-interaction”. Later, realizing that HCI might be perceived through the lens of interface design, we included also the terms “human-computer-interface” and “computer-human-interface”. We later included the term “human-machine-interaction” due to its relevance. “human-computer-interaction” yielded 56 articles, “computer-human-interaction” yielded 4 articles, “human-machine-interaction” yielded 35 articles, “machine-human-interaction” yielded 0 articles, “human-computer-interface” yielded 20 articles, “computer-human-interface” yielded 2 articles. In total 117 unique records were then imported to the reference management tool *Zotero*.

### 2.2 Inclusion/Exclusion Criteria

The inclusion criteria are peer-reviewed empirical research or literature reviews on the topic of HCI. We excluded non-empirical publications including abstracts,

editorials, commentaries, book reviews, viewpoints, opinions, and irrelevant literature reviews. We included 53 articles in the final dataset.

**Table 1.** Codes observed from a first pass on the literature

Code	Sub Code	Description
Year of Publication		The year the article was published
Publishing Journal		Several journals are published under Nature. This category identifies the Nature journal which the article was published at.
Field of Research	Biology	Journal articles in the field of Biology which mentioned the term "Human-Computer Interaction"
	Chemistry	Journal articles in the field of Chemistry which mentioned the term "Human-Computer Interaction"
	Computer Science	Journal articles in the field of Computer Science which mentioned the term "Human-Computer Interaction"
	Dental	Journal articles in the field of Dentistry which mentioned the term "Human-Computer Interaction"
	Ecology	Journal articles in the field of Ecology which mentioned the term "Human-Computer Interaction"
	Engineering	Journal articles in the field of Engineering which mentioned the term "Human-Computer Interaction"
	Information Studies	Journal articles in the field of Information Studies which mentioned the term "Human-Computer Interaction"
	Medical	Journal articles in the Medical field which mentioned the term "Human-Computer Interaction"
	Neuroscience	Journal articles in the field of Neuroscience which mentioned the term "Human-Computer Interaction"
	Psychology	Journal articles in the field of Psychology which mentioned the term "Human-Computer Interaction"
Type of Study	Systems Paper	Systems papers are articles describing a hardware or a software system design or tool where authors explicitly mentioned that their system contributes to the field of "Human-Computer Interaction"
	Empirical Study	Empirical studies are reported experimental studies in various fields where the authors mentioned explicitly that the study contributes to the field of "Human-Computer Interaction"
	Evaluation/Usability Study	Usability Studies are specific to evaluating software systems and interface use
Context	Literature Review	Literature Reviews which mentioned "Human-Computer Interaction" explicitly
	Literally	Refers to using the term to describe interactions between humans and computers rather than intending to use the term to refer to the actual research field of Human-Computer Interaction
	Independent Field of Study	The term "Human-Computer Interaction" was used to refer to the Human-Computer Interaction as an independant research field
	User Interfaces	The term "Human-Computer Interaction" was used to refer to user interfaces or the mere act of humans using software interfaces
	Field of Collaborators	The term "Human-Computer Interaction" was used to refer to the field of research of collaborators in study described in the article
	Futuristic Interfaces	The term was used in the context of articles describing Skin Sensors, Wearables and Display Technology

### 2.3 Data Extraction and Analysis

We employed the Qualitative Analysis of Content method for the preliminary analysis. The first author reviewed the citation records of the 53 included articles. We identified the coding schema based on a first pass across the 53 included articles described in Table 1. The selected articles were then coded using the extracted schema using Microsoft Excel as follows: Year of publication, Publishing Journal, Field of Research (Biology, Chemistry, Computer Science, Dental, Ecology, Engineering, Information Studies, Medical, Neuroscience, Psychology), Type of Study (Systems Paper, Empirical Study, Evaluation/Usability Study, Literature Review), Context in which the term was mentioned (Literal Context, Mentioned as an Independent Field of Study, Mentioned in the Context of User Interfaces, Mentioned as the Field of Collaborators, Mentioned in the Context of Futuristic Interfaces; Skin Sensors, Wearables and Display Technology).

### 3 Results

The 53 articles in the final dataset were published between 1994 and 2018. Mentioning HCI as a research field started in 1994 and through the years the number of times the term was mentioned remained constant until the year 2012 (7%). Through the years 2013 (1%), 2014 (5%), 2015 (15%), 2016 (22.6%), 2017 (25%), 2018 (7% the first quarter) the number of occurrences of the term almost doubled every year. Regarding article types, the articles were empirical studies (26%), literature reviews (13%), evaluation/usability studies (7%), software systems papers (17%) and hardware systems papers (36%). The articles were also distributed among several of Nature's journals. However, Scientific Reports (52%) had most of the articles along with Nature Communications (11%) and the British Dental Journal (9%). The articles mentioned HCI in the following contexts: independent field of research (30%), the literal interaction between humans and computers (24%), user interfaces (17%), futuristic interfaces (13%) and as a field of collaborators (3%).

### 4 Discussion and Conclusion

The preliminary results of our systematic literature review on the usage of the term "human-computer-interaction" and its variants highlight a rapidly increasing interest in relating to the field of HCI by other scientific communities represented in the variety of Nature publications. We showed that the field of HCI has been mentioned in the selected articles across various types, contexts, and fields including Information Studies. Our results also shed light on three conclusions. First, there is an increased interest from other scientific communities to explore HCI as an independent field of research. Second, researchers in the field of HCI should consider perceptions and contributions offered by researchers from outside communities to help shape the future trends of the field of HCI. Finally, communities in Information Studies should embrace HCI as part of its curriculum and as an opportunity to explore the rapid advancements in the way people access information.

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